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ABSTRACT

The standards for accreditation of public schools, adopted by the Arkansas State Board of Education, required the development of these course content guides. The standards also required that essential skills be identified for each course taught in the public schools of Arkansas. Committees of classroom teachers, curriculum specialists, principals, superintendents, staff members from institutions of higher education and Department of Education personnel jointly identified the skills included in each of the guides. These guides are offered as a framework on which a curriculum can be built. Included are guides for Mathematics--Grade 7, Grade 8; Math I, II and III (Grade 9); and General Mathematics and Advanced Mathematics (after Grade 8). At each grade level, skills have been identified at three instructional levels: basic, developmental, and extensions. The basic skills are those skills which all students must master. They are also the skills on which the Minimum Performance Test items are based. A comprehensive guide should exceed minimum levels of expectation. Developmental skills and extensions are also included. Developmental skills are those skills beyond the basic level that should be introduced and taught, but not necessarily mastered by all learners. Often developmental skills at one grade level become basic skills at a later grade or in a more advance course. Extensions are suggested for those learners who have mastered the required basic and recommended developmental skills. Extensions stress the higher order thinking, processing and problem solving skills. These extensions suggest ways for the teacher to broaden student learning on grade level without introducing more basic skills from subsequent grade levels. (TW)

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Mathematics
GRADE 7

NUMERATION

Basic Skills

1.1 Identify the place value of each digit in a whole number of 9 digits.
1.2 Recognize the word name for a standard numeral through hundred-millions.
1.3 Recognize the standard numeral for the word name of a whole number through hundred-millions.
1.4 Round whole numbers to the nearest tens, hundreds, ..., through millions.
1.5 Identify place value in decimals through thousandths.
1.6 Round decimals to the nearest whole number, tenth or hundredth.
1.7 Recognize the word name of a decimal through thousandths.
1.8 Recognize the standard form of a decimal through thousandths, given the word name.
1.9 Compare two decimals to thousandths. (Include some whole numbers.)
1.10 Compare two fractions with unlike denominators of 10 or less.

Developmental Skills

1.25 Write whole numbers in expanded notation.
1.26 Write whole numbers in scientific notation.
1.27 Write a decimal in expanded notation.
1.28 Write a decimal in scientific notation.
1.29 Order a set of three or more decimals.
1.30 Order a set of three or more fractions with unlike denominators.

Extensions

1.75 Multiply or divide numbers using scientific notation.
1.76 Investigate other number bases; do computations in other base systems.
1.77 Determine a term of a sequence, given the first 5 or 6 terms; develop a sequence.
1.78 Generate a sequence.

WHOLE NUMBERS

Basic Skills

2.1 Add three or more six-digit numbers.
2.2 Subtract two six-digit numbers.

2.3 Multiply a two or three-digit number by a three-digit number.
2.4 Divide a four-digit number by a two-digit number (with or without a remainder).
2.5 Solve one-step or two-step reading problem.
2.6 Find the greatest common factor of two whole numbers with no more than two digits.
2.7 Find the least common multiple of two whole numbers with no more than two digits.

Developmental Skills

2.25 Divide by a three-digit divisor.
2.26 Evaluate numerical phrases with grouping symbols.
2.27 Estimate answers to whole number computation problems.
2.28 Solve reading problems involving more than two steps.
2.29 Test whole numbers for divisibility by 2, 3, 5, and 10.
2.30 Identify numbers as prime or composite.
2.31 Express a composite number as a product of prime factors.
2.32 Express a product of like factors in exponential form.
2.33 Write the standard name for a number expressed in expotential form.
2.34 Find the square root of perfect squares less than or equal to 100.
2.35 Find the greatest common factor of three whole numbers.
2.36 Find the least common multiple of three whole numbers.
2.37 Solve an equation with one variable (one operation).

Extensions

2.75 Evaluate numerical phrases with or without grouping symbols.
2.76 Identify examples of properties of addition and multiplication (Commutative, associative, distributive, addition property of one).
2.77 Find the square root to the nearest tenth of a whole number less than 150.
2.78 Solve an equation with one variable (2 or more operations).
2.79 Explore number systems for properties.
2.80 Investigate other methods of computation – lattice multiplication, Russian peasant multiplication, scratch method of subtraction, etc.; explain "why".

RATIONAL NUMBERS

Basic Skills

3.1 Write a fraction with denominators 100 or less in simplest form.
3.2 Write a fraction as an equivalent fraction with a larger numerator and denominator.
3.3 Change an improper fraction to a whole number or mixed number.
3.4 Change a mixed number to an improper fraction.
3.5 Find the reciprocal of a whole number or fraction.
3.6 Add decimals through thousandths. (Include adding a decimal and whole numbers.)
3.7 Subtract decimals through thousandths. (Include subtracting a decimal from a whole number.)
3.8 Multiply a two or three-digit decimal by a three-digit decimal.
3.9 Divide a decimal by a two-digit whole number.
3.10 Write a whole number percent as a fraction.
3.11 Write a whole number percent as a decimal.
3.12 Write a decimal as a percent.

Developmental Skills

3.25 Find the reciprocal of a mixed number.
3.26 Simplify a mixed number such as 3 7/4.

3.27 Add fractions with unlike denominators that do not exceed 2 digits, stating the sum in simplest form.
3.28 Subtract fractions with unlike denominators that do not exceed two-digits, stating the difference in simplest form.
3.29 Multiply fractions with denominators that do not exceed two digits, stating the product in simplest form.
3.30 Divide fractions with denominators that do not exceed two digits, stating the quotient in simplest form.
3.31 Add mixed numbers with unlike denominators that do not exceed two digits, stating the sum in simplest form.
3.32 Subtract mixed numbers with unlike denominators that that do not exceed two digits, stating the difference in simplest form.
3.33 Multiply mixed numbers with denominators that do not exceed two digits, stating the product in simplest form.
3.34 Divide mixed numbers with denominators that do not exceed two digits, stating the quotient in simplest form.
3.35 Represent a ratio as a fraction.
3.36 Solve a proportion when three parts are given.
3.37 Solve reading problems using fractions.
3.38 Change a decimal through thousandths to a common fraction (not in simplest form).
3.39 Change a common fraction with one or two digit denominator to a decimal.
3.40 Divide a decimal with no more than five digits by a decimal with two digits.
3.41 Estimate answers to computation problems containing decimals.
3.42 Solve consumer type reading problems which involve decimals.
3.43 Write mixed number percents and percents less than 1% as decimals.
3.44 Write mixed number percents and percents less than 1% as fractions.
3.45 Write a common fraction with a denominator of no more than two digits as a percent.
3.46 Solve a percent problem using a proportion.
3.47 Solve consumer type reading problems that require finding a percent.

Extensions

3.75 Estimate answers to computation problems containing fractions.
3.76 Solve reading problems using proportions.
3.77 Solve reading problems (not consumer) which require the use of decimals.
3.78 Solve reading problems involving percents.

MEASUREMENT

Basic Skills

4.1 Identify the freezing point and boiling point of water and normal body temperature using Fahrenheit and Centigrade.
4.2 Identify the metric prefixes milli, centi, deci, deka, hecto and kilo with their respective decimal values (1/1000, 1/100, 1/10, 10, 100, 1000).
4.3 Determine the length of a line segment to the nearest centimeter or ¼ inch.

Developmental Skills

4.25 Convert one unit of measure to another within the same system.
4.26 Select a reasonable metric measure for length or distance, liquid volume or capacity or mass (mm, cm, m, mg, g, kg; ml, l).
4.27 Select a reasonable customary measure for length or distance, liquid volume or capacity or mass (inch, foot, yard, mile; ounce, pound, ton; pint, quart, gallon).
4.28 Determine the length of a line segment to the nearest tenth of a centimeter (mm) or ⅛ of an inch.
4.29 Solve computation problems involving time, temperature, length, capacity and mass using both customary and metric units.
4.30 Identify or illustrate models representing the units of measure for area and volume.

Extensions

4.75 Read and interpret scales and scale drawings.
4.76 Make scale drawings and/or scale models.
4.77 Investigate metric prefixes larger than kilo and smaller than milli and their application.

GEOMETRY

Basic Skills

5.1 Identify circles, triangles, quadrilaterals and octogans.
5.2 Identify the center, radius and diameter of a circle.
5.3 Find the perimeter of any polygon.
5.4 Find the area of a square and rectangle.

Developmental Skills

5.25 Identify other two and three-dimensional geometric figures and relationships including parallel lines, perpendicular line, angles, pentagons, hexagons, cubes, rectangular solids, pyramids, cones, cylinders and spheres.
5.26 Recognize congruent and similar geometric figures.
5.27 Measure an angle.
5.28 Classify angles as acute, right or obtuse.
5.29 Classify triangles by measures of angles and lengths of sides.
5.30 Use angle relationships in geometric figures.
5.31 Find the area of a triangle, parallelogram and trapezoid.
5.32 Find the circumference and area of a circle.
5.33 Find the volume of cubes, rectangular solids and cylinders.
5.34 Solve 1-step reading problems involving geometric figures.
5.35 Construct congruent line segments and angles, bisectors of angles and line segments, perpendicular and parallel lines.
5.36 Identify other terms related to a circle (chord, semi-circle, sector arc, central angle, inscribed angle).

Extensions

5.75 Determine corresponding measures in congruent or similar polygons.
5.76 Find the volume of a cone, pyramid, prism and sphere.
5.77 Find the surface area of a prism, cylinder and sphere.
5.78 Find the area of a sector of a circle.

PROBABILITY AND STATISTICS

Basic Skills

6.1 Read and interpret charts, tables and graphs (bar, line, circle and pictograph).

Developmental Skills

6.25 Find the probability and/or odds of an event.
6.26 Organize a collection of data and look for pattern development.
6.27 Construct a line graph, bar graph, circle graph and pictograph.
6.28 Identify measures of central tendency (mean, median and mode) of a set of numbers.
6.29 Solve simple reading problems involving probability and statistics.

Extensions

6.75 Determine the probability of compound events either dependent or independent.
6.76 Collect and analyze data to make predictions.

INTEGERS

Basic Skills

None

Developmental Skills

7.25 Identify the set of integers.
7.26 Compare or order a set of integers.
7.27 Determine the absolute value of an integer.
7.28 Add two or more integers.
7.29 Subtract two or more integers.
7.30 Divide two integers.
7.32 Solve reading problems which require using a set of integers.
7.33 Find and graph the solution sets of simple equations and inequalities containing one variable.
7.34 Graph an ordered pair of integers on a coordinate plane.
7.35 State the coordinates of a point on a coordinate plane.

Mathematics
GRADE 8

NUMERATION

Basic Skills

1.1 Identify the place value of each digit in a whole number with no more than ten digits.
1.2 Recognize the word name for a standard numeral through billions.
1.3 Recognize the standard numeral for the word name of a whole number through billions.
1.4 Round whole numbers to the nearest tens, hundreds,..., through billions.
1.5 Identify place value in decimals through thousands.
1.6 Round decimals to nearest whole number, tenth or hundredth.
1.7 Recognize the word name of a decimal through thousandths.
1.8 Recognize the standard form of a decimal through thousandths, given the word name.
1.9 Compare two decimals to thousandths (include some whole numbers).
1.10 Compare two fractions with unlike denominators 10 or less.

Developmental Skills

1.25 Write whole numbers in expanded notation.
1.26 Write whole numbers in scientific notation.
1.27 Write a decimal in scientific notation.
1.28 Order a set of three or more decimals.
1.29 Order a set of three or more fractions with unlike denominators.
1.30 Write a decimal in expanded notation.

Extensions

1.75 Multiply and/or divide numbers in scientific notation.
1.76 Work with other bases. Change other base numerals to base 10 numerals. Do computation in other bases.

WHOLE NUMBERS

Basic Skills

2.1 Add three or more six digit whole numbers.
2.2 Subtract two six digit whole numbers.
2.3 Multiply up to a three digit whole number by a three digit whole number.
2.4 Divide up to a five digit whole number by a two digit whole number.
2.5 Estimate answers to whole number computation problems.
2.6 Solve reading problems involving one or two operations with whole numbers.
2.7 Find the greatest common factor of two or three whole numbers with no more than two digits.
2.8 Find the least common multiple of two or three whole numbers with no more than two digits.

Developmental Skills

2.25 Evaluate numerical phrases with or without grouping symbols using order of operations.
2.26 Estimate answers to whole number reading problems.
2.27 Identify examples of properties of addition and multiplication, such as commutative, associative, distributive, addition property of zero and multiplication property of one.

2.28 Test whole numbers for divisibility by 2, 3, 5, 6, 9 and 10.
2.29 Identify numbers as prime or composite.
2.30 Express a composite number as a product of prime factors.
2.31 Express a product of like factors in exponential form.
2.32 Write the standard name for a number expressed in exponential form.
2.33 Find the square root to the nearest tenth of a whole number less than 150.
2.34 Solve an equation with one variable.
2.35 Multiply or divide numbers by powers of 10.

Extensions

2.75 Investigate the concept of function; find values using function notation.
2.76 Create number systems that maintain given properties (i.e., commuatative, associative, identity, etc.).
2.77 Investigate short cuts or method for rapid mental computations.
2.78 Create multi-step word problems.

RATIONAL NUMBERS

Basic Skills

3.1 Change a fraction to an equivalent fraction with a given denominator which does not exceed two digits.
3.2 Add two or more fractions with unlike denominators that do not exceed two digits, stating the sum in simplest form.
3.3 Subtract two fractions with unlike denominators that do not exceed two digits, stating the difference in simplest form.
3.4 Multiply two fractions with denominators that do not exceed two digits, stating the product in simplest form.
3.5 Change a decimal (through thousandths) to a common fraction (not necessarily in simplest form).
3.6 Change a common fraction to a decimal (denominators not to exceed 100).
3.7 Add two or more decimals through thousandths. (Include some with whole numbers.)
3.8 Subtract decimals through thousandths. (Include some with whole numbers.)
3.9 Multiply a decimal with no more than three digits by a decimal with no more than three digits.
3.10 Divide a decimal by a two digit whole number.
3.11 Solve consumer type reading problems which require the use of decimals (no division).
3.12 Write a percent, exclusive of those having decimals or fractional parts, as a fraction.
3.13 Write a percent, exclusive of those having decimals or fractional parts, as a decimal.
3.14 Write a decimal as a percent.
3.15 Solve consumer type reading problems that require finding the percent of a number.

Developmental Skills

3.25 Divide fractions with denominators that do not exceed two digits.
3.26 Add mixed numbers with demoninators that do not exceed two digits, stating sum in simplest form.
3.27 Subtract mixed numbers with denominators that do not exceed two digits, stating difference in simplest form.
3.28 Multiply mixed numbers with denominators that do not exceed to digits, stating product in simplest form.
3.29 Divide mixed numbers with denominators that do not exceed to digits, stating quotient in simplest form.
3.30 Estimate answers to computation problems containing fractions.
3.31 Represent a ratio as a fraction.
3.32 Solve a proportion when three parts are given.
3.33 Solve reading problems using fractions.
3.34 Solve reading problems using proportions.
3.35 Divide a decimal with five digits by a decimal with two digits.
3.36 Estimate answers to decimal computation problems.
3.37 Solve reading problems which require the use of decimals.
3.38 Write a common fraction with a denominator of no more than two digits as a percent.
3.39 Solve a percent problem using a proportion.
3.40 Solve reading problems involving percents.
3.41 Multiply or divide decimals by powers of 10.

Extensions

3.75 Solve equations with one variable containing fractions or decimals.
3.76 Create word problems involving fractions or decimals.
3.77 Investigate fractional bases such as base ½.

MEASUREMENT

Basic Skills

4.1 Select a reasonable metric measure for length, distance, capacity or mass (using metric units: meter, centimeter, millimeter, kilogram).
4.2 Select a reasonable customary measure for length or distance, liquid volume or capacity or mass (using measures: inch, foot, yard, mile, ounce, ton, pint, gallon or quart).
4.3 Convert from one unit of measure to another within the same system.
4.4 Determine the length of a line segment to the nearest tenth of a centimeter or eighth of an inch.

Developmental Skills

4.25 Estimate and determine measurements of area using both customary and metric units.
4.26 Perform computations involving time, temperature, length, capacity and mass using both customary and metric units.

Extensions

4.75 Solve reading problems involving units of measure.
4.76 Make scale drawings and/or scale models.
4.77 Determine from a scale drawing the amount of materials needed and the cost of the materials to construct the building represented by the drawing.
4.78 Investigate methods and devices for measurements.

GEOMETRY

Basic Skills

5.1 Identify circles, triangles, quadrilaterals and octogons.
5.2 Find the perimeter of any polygon.
5.3 Find the area of a square and rectangle.

Developmental Skills

5.25 Identify other two and three-dimensional geometric figures and relations including parallel lines, perpendicular lines, angles, pentagons, hexagons, cubes, rectangular solids, pyramids, cones, cylinders and spheres.
5.26 Identify congruent and similar geometric figures.
5.27 Measure an angle.
5.28 Determine angle measures and relationships in geometric figures.
5.29 Find the perimeter and area of polygons.
5.30 Find the circumference and area of a circle.
5.31 Find the volume of cubes, rectangular solids and cylinders.
5.32 Find the missing side of similar polygons by using proportions.
5.33 Solve reading problems involving geometric figures.

Extensions

5.75 Identify line symmetry properties in geometric figures.
5.76 Find sector area and arc length.
5.77 Investigate special geometry topics such as topology, transformations, tesselations and networks.
5.78 Develop a formula for finding the sum of the measures of the angles of a polygon.

PROBABILITY AND STATISTICS

Basic Skills

6.1 Read and interpret charts, tables and graphs (bar, circle, line and pictograph).

Developmental Skills

6.25 Find the probability and/or odds of an event.
6.26 Organize a collection of data and look for pattern development.
6.27 Construct a line, bar, circle and pictograph.
6.28 Identify measures of central tendency (mean, median and mode) of a set of numbers.
6.29 Solve simple reading problems involving probability and statistics.

Extensions

6.75 List permutations or combinations for a given set of n objects taken r at a time and analyze the results to find a formula for permutations and combinations.
6.76 Investigate applications of measures of central tendency.

INTEGERS

Basic Skills

7.1 Compare and order a set of integers.

Developmental Skills

7.25 Determine the absolute value of an integer.
7.26 Add integers.
7.27 Subtract integers.
7.28 Multiply integers.
7.29 Divide integers.
7.30 Identify the additive inverse and reciprocal of an integer.
7.31 Find the solution set and sketch the graph of simple linear equations.
7.32 Solve reading problems which require using a set of integers.
7.33 Graph an ordered pair of integers on a coordinate plane and state the coordinates of a point in a coordinate plane.
7.34 Write integers as exponents and interpret their meaning; multiply and divide powers of numbers (integers).

Extensions

7.75 Graph a linear equation with two variables on a coordinate plane.
7.76 Identify numbers as counting, whole, integers, rational, irrational or real.
7.77 Solve a system of linear equations by graphing.

Arkansas Public School Course Content Guide

MATH I MATH II MATH III

FINAL DRAFT

SE

MATH I

Upon completion of the eighth grade, it is assumed that the student has mastered the basic computational skills. Therefore the emphasis throughout this course is on specific problem solving strategies supported by the use of calculators and computers rather than rote computation. Estimation must be used to determine if a solution is reasonable.

Students become problem solvers by solving problems. In this guide the basic skills provide the necessary skills and mathematics foundation for students to be successful in the problem solving process. However, continual practice is essential. In this guide basic skills are emphasized. Where developmental and extension skills are not listed, teachers are encouraged to develop and extend the basic skills by providing additional problems to reinforce these basic skills.

Care has been taken to include topics and skills that will easily span the amount of instructional time available during the school year. This structure should allow adequate flexibility for teachers to include computer assisted instruction or reteaching where needed.

CALCULATORS

1. Identify placement of keys on the keyboard and the use of various function keys.
2. Perform the four basic operations on whole numbers using the calculator.
3. Perform the four basic operations on decimal numbers using the calculator.
4. Estimate to determine if a calculated answer is reasonable.
5. Determine when the use of a calculator is and is not advantageous.

PROBLEM SOLVING

1. Define problem and problem solving.
2. List the steps of the problem solving process.
3. Identify typical errors in problem solving.
4. Identify basic problem solving strategies.
   a. pattern recognition
   b. guess and check
   c. working backwards
   d. elimination
   e. logical deduction
   f. solve a simpler problem
5. Identify the appropriate strategy for solving various single step problems.
6. Using the problem solving process and appropriate strategy, solve problems with calculator and check answers by estimation.

NUMERATION

1. Identify the standard form of a decimal through hundred thousandths, given the word name.

2. Compare two decimal numbers containing up to five decimal places.

3. Compare two fractions with unlike denominators of 10 or less.

4. Order a set of three or more decimal numbers.

5. Order a set of three or more fractions with unlike denominators.

WHOLE NUMBERS

1. Review the four basic operations with whole numbers of from three to six digits.

2. Test whole numbers for divisibility by two, three, five, six, nine and ten.

3. Identify numbers as prime or composite.

4. Express a composite number as a product of prime factors.

5. Express a product with like factors using exponential form.

6. Write the standard name for a number expressed in exponential form.

7. Estimate the square root of a number to the nearest whole number and check accuracy with the calculator.

8. Solve problems involving whole numbers, using the calculator and appropriate problem solving strategy. Use estimation to check answer.

RATIONAL NUMBERS

1. Review the four basic operations with fractions having denominators that do not exceed two digits.

2. Review the four basic operations with mixed numbers having denominators that do not exceed two digits.

3. Estimate answers to computations involving fractions and mixed numbers.

4. Solve problems involving fractions and mixed numbers, using appropriate problem solving strategies.

5. Change fractions and mixed numbers with denominators of 100 or less to decimals.

6. Divide decimals and whole numbers by decimals with up to three decimal places.

7. Estimate answers to decimal computations.

8. Solve problems involving decimals, using problem solving strategies and a calculator.

9. Express fractions and decimals as percents and percents as fractions and decimals.

10. Find a percent of a number.

11. Solve problems involving percents using appropriate problem solving strategy and a calculator.

12. Estimate answers to percent problems to determine if answer is reasonable.

GEOMETRY AND MEASUREMENT

1. Select reasonable customary measurement units for length or distance, volume, weight or mass, time and temperature.

2. Estimate and then find the actual measurement using customary units and various measurement devices.

3. Select reasonable metric measurement units for length or distance, volume and weight or mass.

4. Estimate and then find the actual measurement using metric units.

5. Convert from one unit of measurement to another within the same system.

6. Solve problems involving measurement units (customary and metric) for length, capacity, weight or mass, time, and temperature using problem solving strategies and calculators.

7. Identify two dimensional geometric figures and geometric relations including parallel and perpendicular lines, angles, quadrilaterals, pentagons, hexagons and octagons.

8. Identify three dimensional geometric figures and geometric relations including cubic, rectangular solids, pyramids, cones, cylinders and spheres.

9. Identify congruent and similar geometric figures.

10. Measure angles.

11. Identify side and angle relationships in such geometric figures as squares, rectangles, parallelograms, and equilateral, isosceles and right triangles.

12. Find the perimeter and area of polygons.

13. Find the circumference and area of circles.

14. Find the volume of rectangular solids.

15. Solve problems involving geometric figures (customary and metric units) using problem solving strategies and a calculator.

16. Estimate to determine if an answer is reasonable.

STATISTICS

1. Read and interpret charts, tables and graphs (bar, circle, line and pictographs).

2. Organize a collection of data and look for pattern development.

3. Construct line, bar, circle and pictographs.

4. Identify or calculate range, mean, median and mode of a set of numbers.

5. Solve problems involving statistics using problem solving strategy and calculator.

MATH II

Math II is designed as a continuation of Math I, not a repeat of skills designed for mastery in previous courses. Some review, reinforcement and extension of the problem solving strategies are essential. The use of hand-held calculators and computers is also encouraged so that emphasis may be given to concept development in addition to computation.

INTRODUCTION TO ALGEBRA

Basic Skills

1. Define signed numbers using a number line.
2. Represent real life situations such as gain or loss, up or down, and temperature change using signed numbers.
3. Compare and order a set of signed numbers.
4. Determine the absolute value of signed numbers.
5. Determine the opposite and reciprocal of signed numbers.
6. Perform the four basic operations using signed numbers (without calculators).
7. Evaluate expressions containing signed numbers with and without grouping symbols using order of operations.
8. Review problem solving strategies.
   a. pattern recognition
   b. guess and check
   c. working backwards
   d. elimination
   e. logical deduction
   f. solve a simpler problem
9. Solve problems involving strategies (with and without calculators).
10. Define variable.
11. Evaluate variable expressions and geometric formulas using substitution.
12. Solve equations using one or more operations.
13. Convert word expressions to algebraic expressions and equations.
14. Solve simple reading problems involving equations containing one or two operations.
15. Identify the axes, origin and quadrants within the coordinate plane.
16. Name a point within the coordinate plane as an ordered pair.
17. Graph an ordered pair in the coordinate plane.

Developmental Skills

1. Graph a linear equation.

NUMERATION

Basic Skills

1. Multiply and divide whole and decimal numbers by powers of ten.
2. Write whole and decimal numbers in scientific notation.

Developmental Skills

3. Multiply and divide numbers in scientific notation.

RATIO AND PROPORTION

Basic Skills

1. Express a ratio in three forms. (decimal, fraction, percent)
2. Determine if two ratios form a proportion.
3. Find the fourth part of a proportion when three are given.
4. Express the probability of an event as a ratio.
5. Solve simple reading problems involving ratios and proportions using problem solving strategies and calculators.

Developmental Skills

1. Determine distances between cities using the scale on a road map.
2. Find the length of an unknown side in similar polygons.
3. Find speed using d = r x t formulas.

PERCENTS

Basic Skills

1. Convert decimals and fractions to percents.
2. Convert percents to decimals and fractions.
3. Express the probability of an event as a percent.
4. Find a percent of a number.

5. Find what percent one number is of another.

6. Find a number when a percent of it is known.

7. Solve problems involving percents using problem solving strategies and calculators.

Developmental Skills

1. Calculate the rate of increase or decrease.

2. Calculate the rate of discount.

3. Calculate the rate of commission.

4. Calculate the annual interest rate.

5. Calculate the rate of gain or loss.

GEOMETRY AND MEASUREMENT

Basic Skills

1. Convert from one unit to another within the same system, metric and customary units of length, capacity and weight.

2. Add and subtract customary and metric units of time, length, capacity and weight giving answers in simplest form.

3. Review and extend formulas for area and perimeter of circles and polygons.

4. Find the volume of three dimensional figures.

Developmental Skills

1. Analyze irregular figures formed from combinations of polygons, semicircles and circles to determine perimeter and area.

2. Find the surface area of three dimensional figures.

3. Write and solve proportion to find unknown heights and distances in similar polygons.

MATH III

INTRODUCTION

Math III includes topics generally contained in consumer and/or business mathematics courses. Prerequisite for the course is the successful completion of two years of high school mathematics. This would indicate mastery of the following skills:

* computating with the four basic operations using whole numbers, decimals and fractions;
* finding the percent of a number;
* writing ratios and proportions;
* expressing a decimal as a percent and a percent as a decimal;
* using the formula for determining rate;
* reading graphs, tables and charts;
* adding and subtracting time;
* expressing units of time in decimal and/or fraction form;
* computing area and perimeter of specific polygons;
* computing circumference and area of a circle;
* finding volume of rectangular solids;
* solving formulas for a given variable;
* reading a ruler; and
* finding averages.

This course emphasizes process through practical applications rather than reteaching computation. Major stress will be placed on estimation and vocabulary. Computational skills may need to be reviewed but should not be the major focus of the course. Students will be taught to effectively use calculators to perform computations.

Computers may be used if appropriate software is available. The General Math programs developed by the Asbury Park, New Jersey schools is an example of appropriate software.

The following course content guide has suggested teaching strategies or ideas given in parentheses. Methods of teaching are left to the descretion of the teacher. Student interest in some of the topics in this guide may be stimulated by the use of community resource people.

AUTOMOBILE OWNERSHIP

Basic Skills

1. Find the initial cost of a car including taxes, title, registration and license.

2. Determine the down payment and the amount to be financed.

3. Use a table or multiplier to find the amount of the monthly payment. (Use the computer for a table or a local resource for a multiplier.)

4. Calculate the cost of insurance, given the rating factor.

5. Calculate fuel costs and miles per gallon. (Use ratio and proportion)

6. Determine the cost of tires, batteries and other maintenance items.

Developmental Skills

1. Compare the cost of a new and used car.

2. Compare financing cost from different sources, i.e., bank, car dealer, credit unions, etc.

3. Compare the cost of paying cash to financing.

4. Compare the cost of insurance for different classifications i.e., sex, age, use, etc.

5. Determine the yearly cost of owning an automobile.

Extensions

1. Compare buying a car to leasing a car.

2. Investigate the meaning of "as is" warranties.

PERSONAL INCOME

Basic Skills

1. Read and interpret 12-hour time cards to find the total hours worked.

2. Calculate the gross wages based on hourly rates.

3. Find overtime rates, overtime wages and gross wages which include the overtime wages.

4. Find the amount of net pay, given amount of each deduction.

5. Complete a W-4 withholding form and a 1040 EZ income tax form given the annual gross wages. (Consult IRS for free tax materials.)

Developmental Skills

1. Read and interpret 24-hour time cards to find the total hours worked.

2. Find the annual wages, given the length of the payroll period and the wage for the payroll period.

3. Determine the gross wages, given the pay per piece and the number of pieces.

4. Determine the gross wages, given the salary, commission and sales.

5. Find the profit of a small business, given the earnings and expenses.

6. Find the amount of each deduction, i.e., social security, income tax, insurance, etc.

7. Complete the 1040A and State of Arkansas income tax forms.

Extensions

1. Use available computer software to compute wages.

2. Use newspaper want ads to compare earnings for different jobs.

3. Administer an actual employment test.

4. Simulate establishing a part-time business i.e., lawn mowing.

PURCHASING CONSUMER GOODS

Basic Skills

1. Find the total price of a purchase including sales tax.

2. Determine the unit price.

3. Calculate the discount and sale price, given the rate of discount.

4. Calculate the rate of discount to find the best buy.

5. Determine the correct amount of change.

6. Determine the correct amount of change using the fewest numbers of coins and bills possible. (Use play money.)

Developmental Skills

1. Find the discount and the sale price given a first and second rate of discount.

2. Compare "rent to own" to outright purchasing.

3. Determine the correct amount of change when coins are added to the amount payed in order to minimize the number of coins received.

Extensions

1. Compare convenience purchases with home preparation.

2. Compare costs using the Consumer Price Index.

CREDIT PURCHASES

Basic Skills

1. Read and interpret a charge account statement. (Copies of charge statements will be useful.)
2. Calculate the finance charges using the previsous balance method, the unpaid balance method, and the average daily balance method.
3. Determine the amount of available credit.

Developmental Skills

1. Compare short term loans with installment buying.
2. Compare the difference in cost using various methods for calculating the finance charge.
3. Find the annual percentage rate, given the amount borrowed and the amount paid.

MONEY MANAGEMENT

Basic Skills

1. Complete a deposit slip.
2. Write a check.
3. Keep a check register and/or check stubs.
4. Read and interpret a bank statement.
5. Deposit money in a savings account.
6. Calculate simple interest.
7. Use a table to find compound interest.
8. Determine the face value, issue price and interest at maturity for a savings bond.

Developmental Skills

1. Compare monthly charges on different types of checking accounts.
2. Reconcile a bank statement.
3. Calculate compound interest.

Extensions

1. Calculate the cost of money orders, certified checks and cashier's checks.
2. Compare interest received from different types of interest bearing accounts.
3. Calculate the cost of early withdrawal.
4. Simulate the purchase of stocks and bonds over a period of time.
5. Compare advantages and disadvantages for the different types of life insurance.
6. Discuss other types of investments, i.e., real estate, hobbies, precious metals etc.

LIVING EXPENSES

Basic Skills

1. Prepare a family budget.
2. Determine the initial cost of moving into an apartment or house, i.e., deposit for utilities, security deposits, etc.
3. Investigate the cost of renter's insurance or homeowner's insurance.
4. Read utility meters.
5. Calculate individual and total utility costs.
6. Measure the length, width and height of objects.
7. Determine the cost of home improvements which involve finding the area, i.e., carpet, wall paper, sod for lawn.

Developmental Skills

1. Determine the cost of home improvements which involve finding the volume, i.e., hot water heater, fill swimming pool.
2. Read and construct a scale drawing.
3. Compare the cost of renting a home to owning a home.

Extensions

1. Investigate millage rates and calculate real estate taxes.
2. Research personal property taxes.
3. Determine costs involved in purchasing a home.
4. Investigate ways to illustrate a family budget, i.e., circle graphs.

TRAVEL, LEISURE AND RECREATION

Basic Skills

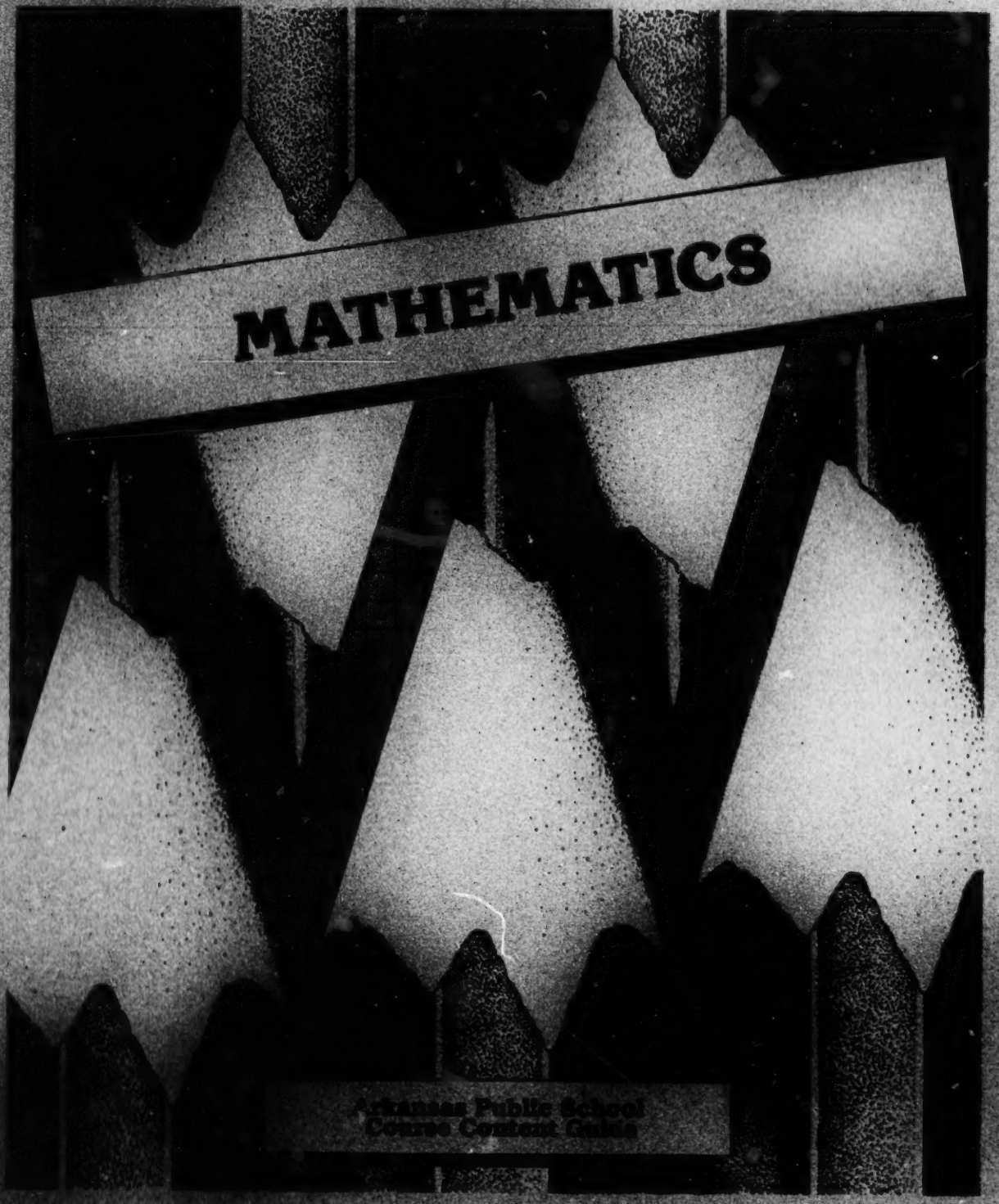
1. Determine distances using a map scale. (Secure a classroom set of maps of Arkansas.)
2. Find a location on a map, using an index and coordinates.
3. Use book club or record club advertisements to find hidden costs of memberships.
4. Compare the cost of different hobbies.
5. Compare the cost of different recreational activities.

Developmental Skills

1. Compare time and costs of different types of transportation.
2. Use a time-zone map to determine the arrival time.

Extensions

1. Plan and calculate the costs of a vacation.
2. Investigate the necessities of overseas travel.


MATHEMATICS
Arkansas Public School
Course Content Guide

INTRODUCTION

The STANDARDS FOR ACCREDITATION OF PUBLIC SCHOOLS, adopted by the Arkansas State Board of Education, required the development of these course content guides. The Standards also required that essential skills be identified for each course taught in the public schools of Arkansas. Committees of classroom teachers, curriculum specialists, principals, superintendents, staff members from institutions of higher education and Department of Education personnel jointly identified the skills included in each of the guides.

These guides are offered as a framework on which a curriculum can be built; they should not be considered the complete (only) curriculum of a school. After adopting the guides and after careful planning, the local staff should extend them by developing teaching plans, identifying resources, selecting presentation methods and coordinating evaluative techniques with skills to be taught. From these expansions of the course content guides, a more complete curriculum guide can emerge.

Within each subject area and at each grade level, skills have been identified at three instructional levels: basic, developmental and extensions. The basic skills are those skills which all students must master. They are also the skills on which the Minimum Performance Test items are based. A comprehensive guide should exceed minimum levels of expectation. Developmental skills and extensions are also included.

Developmental skills are those skills beyond the basic level that should be introduced and taught, but not necessarily mastered by all learners. Often developmental skills at one grade level become basic skills at a later grade or in a more advanced course.

Extensions are suggested for those learners who have mastered the required basic and recommended developmental skills. Extensions stress the higher order thinking, processing and problem solving skills. These extensions suggest ways for the teacher to broaden student learning on grade level without introducing more basic skills from subsequent grade levels.

The nature of some subject areas requires sequencing of skills. In those subject areas, skills are sequenced by grade level. Sequencing in some subject areas is left to the discretion of the school district and teachers.

The Student Assessment/Minimum Performance testing program coordinates with the statement of basic skills in the course content guides. The Minimum Performance Test measures mastery of basic skills. Promotion from the eighth grade will depend upon mastery of the basic skills listed in the five course content guides for reading, mathematics, language arts, science and social studies.

No curriculum should be considered static. Updating of the guides should be a continuous process. Responses from educators will help determine when revision is needed.

The Department and the State Board of Education recognize the outstanding work of those professional educators who have contributed to the development of these guides. Without their help, this work could not have been accomplished.

General Mathematics

This course content guide was developed as an extension of the skills taught through the eighth grade. Application of real world problems must be an integral part of the general mathematics course. Therefore, calculators and computers should be extensively used so that students can be prepared to function in our technological society.

RATIONAL NUMBERS

Basic Skills

1. Read and write numbers
2. Write numbers in expanded form using exponents.
3. Compare numbers using $<$, $>$ or $=$.
4. Round to the designated place of accuracy.
5. Perform the four basic operations.
6. Evaluate arithmetic expressions using the order of operations.
7. Solve word problems by selecting and using correct operations.
8. Determine if a solution to a mathematics problem is reasonable by estimation.
9. Use calculators to perform operations.
10. Test whole numbers for divisibility by 2, 3, 5, 6, 9 and 10.
11. Identify numbers as prime or composite.
12. Multiply and divide numbers by powers of 10.

Developmental Skills

1. Multiply and divide numbers written in scientific notation.
2. Determine the number of significant digits.
3. Convert Roman numerals to decimal numerals and decimal numerals to Roman numerals.
4. Use the square root algorithm to extract a square root.
5. Write numbers in scientific notation.
6. Express a composite number as a product of prime factors in exponential form.

Extensions

1. Add and subtract numbers in scientific notation.
2. Work with bases used in computer operation (bases 2, 10, 16).
3. Investigate methods for finding prime numbers.

RATIO & PROPORTION

Basic Skills

1. Express a ratio using three methods.
2. Determine if two ratios form a proportion.
3. Find the missing part of a proportion when three parts are given
4. Solve simple word problems involving ratios and/or proportions.

Developmental Skills

1. Use the scale on a road map to determine the distance between two cities.

Extensions

1. Make a scale model, either two or three-dimensional.

PERCENTS

Basic Skills

1. Convert fractions to decimals.
2. Convert percents to fractions.
3. Convert fractions to percents.
4. Convert percents to decimals.
5. Convert decimals to percents.
6. Convert common fractions or mixed numbers to decimal fractions.
7. Convert decimal fractions to common fractions or mixed numbers.
8. Find a percent of a number.
9. Find what percent one number is of another.
10. Find a number when a percent of it is known.
11. Solve simple word problems involving percents.

Developmental Skills

1. Calculate the rate of increase or decrease.
2. Calculate the rate of discount.
3. Calculate the rate of profit or loss.
4. Calculate the rate of commission.
5. Calculate the annual rate of interest.

Extensions

1. Calculate value of savings using compound interest.
2. Calculate the interest on an account based on the average daily balance.

MEASUREMENT

Basic Skills

1. Convert from one unit to another within the same system (metric and customary).
2. Solve computation problems involving time, temperature, length, capacity and mass using both customary and metric units.
3. Solve word problems involving units of measure.
4. Estimate and determine real world measurements using a reasonable unit.
5. Compare similar units of measure in metric and customary systems.

Developmental Skills

1. Investigate methods and devices for making measurements.
2. Determine the precision and accuracy of a measurement.

Extensions

1. Investigate different methods of converting from one system of measure to another.
2. Make scale drawings and/or scale models.

INTRODUCTION TO ALGEBRA

Basic Skills

1. Determine the absolute value of a signed number.
2. Perform the four basic operations using signed numbers.
3. Identify the additive inverse and reciprocal of a signed number.
4. Compute and graph the solution sets of simple equations and inequalities containing one variable.
5. Solve word problems using signed numbers.
6. Graph an ordered pair of integers on a coordinate plane and state the coordinates of a point in a coordinate plane.
7. Raise numbers to indicated powers.
8. Determine whole number roots of numbers.
9. Solve practical problems using powers and roots.
10. Evaluate algebraic expressions when given values for variables.

Developmental Skills

1. Identify numbers as natural, whole, integers, rational, irrational or real.
2. Identify examples of properties of addition and multiplication, such as commutative, associative, multiplication property of one.
3. Translate word sentences into variable expressions.
4. Simplify expressions by combining like terms.
5. Solve problems by using a given formula.

Extensions

1. Graph linear equations and/or inequalities.
2. Solve a system of linear equations by graphing.

GEOMETRY

Basic Skills

1. Identify two and three-dimensional geometric figures.
2. Identify congruent and similar geometric figures.
3. Measure an angle.
4. Use angle relationships in geometric figures.
5. Find the perimeter and area of polygons.
6. Find the circumference and area of circles.
7. Find the volume of cubes, rectangular solids and cylinders.
8. Solve word problems involving geometric figures.

Developmental Skills

1. Calculate surface area of three-dimensional figures.
2. Make models to demonstrate geometric concepts.
3. Find the missing side of similar polygons by using proportions.

Extensions

1. Find sector area and arc length.
2. Investigate special geometry topics such as topology, transformation and tesselations.
3. Develop a formula for finding the sum of the measures of the angles of a polygon.

PROBABILITY AND STATISTICS

Basic Skills

1. Find the probability and/or odds of an event.
2. Organize a collection of data and look for pattern development.
3. Identify measures of central tendency – median, mean and mode of a set of numbers.
4. Solve simple word problems involving probability and statistics.

Developmental Skills

1. List permutations or combinations for a given set of n objects taken r at a time and analyze the results to find a formula for permutations and combinations.
2. Investigate applications of measure of central tendency.

Extensions

1. Use the computer random number generator to explore the probability of an event.

APPLICATIONS

These are to be used throughout the course where applicable to illustrate mathematics concepts. This list is by no means all-inclusive. Teachers should feel free to explore other topics.

1. Sales tax
2. Discounts
3. Interest
4. Banking
5. Installment buying
6. Computing income
7. Commission
8. Unit pricing
9. Comparison buying
10. Automobile mathematics
11. Budgets
12. Adjusting
13. Mail orders

Algebra I

BASIC LANGUAGE OF ALGEBRA

Basic Skills

1. Use order of operations to simplify numerical expressions involving arithmetic operations, powers or grouping symbols.
2. Simplify expressions containing variables by combining like terms.
3. Evaluate variable expressions by substitution.
4. Write algebraic expressions from words to symbols.
5. Write solution to algebraic equations in set notation.

Developmental Skills

1. Find union and intersection of sets.
2. Simplify variable expressions with decimal and fractional coefficients.

Extensions

1. Evaluate variable expressions using decimals and fractions.
2. Draw and interpret Venn diagrams.

REAL NUMBERS

Basic Skills

1. Identify natural numbers, whole numbers, integers, rational numbers and irrational numbers.
2. Identify and apply the following properties: commutative, associative, distributive, inverse and identity.
3. Perform the four operations with integers.
4. Evaluate algebraic expressions containing integers.
5. Find absolute value.

Developmental Skills

1. Identify and apply the closure property.
2. Perform the four operations with positive and negative decimals and fractions.

Extensions

1. Identify and apply the reflexive, symmetric and transitive properties.
2. Evaluate algebraic expressions using positive and negative decimals and fractions.

EQUATIONS AND INEQUALITIES IN ONE VARIABLE

Basic Skills

1. Solve equations using one or more operations.
2. Solve inequalities using one or more operations.
3. Graph solutions of equations and inequalities on the real number line.
4. Solve equations containing variables in both members.
5. Solve inequalities containing variables in both members.
6. Write and solve equations for simple verbal problems (eg., number, consecutive integer, percent, etc.).
7. Solve equations containing absolute value of the types:
$$[x] = c \quad \text{and} \quad [x] + c = d.$$

Developmental Skills

1. Solve equations and inequalities with decimal and fractional coefficients.
2. Solve equations containing absolute value of the types:
$$[x + c] = d \quad \text{and} \quad [x + c] + d = e.$$
3. Write and solve equations for verbal problems (eg., age, perimeter, area, mixture, coin, angles of a triangle, etc.).
4. Solve a multivariable equation for any variable.
5. Solve and graph conjunctions and disjunctions of inequalities.

Extensions

1. Solve inequalities containing absolute value.
2. Use inequalities to solve verbal problems.
3. Solve mixture and uniform motion problems.

POLYNOMIALS

Basic Skills

1. Identify, classify and find the degree of a polynomial.
2. Add, subtract, multiply and divide monomials and polynomials (linear divisor).
3. Simplify expressions using laws of exponents.
4. Find the greatest common factor (GCF) and least common multiple (LCM).
5. Factor polynomials by using greatest monomial factor.

6. Factor the difference of squares $x^2 - y^2$.
7. Factor a trinomial in the form of $x^2 + bx + c$ with b and c as integers.
8. Solve equations by factoring.

Developmental Skills

1. Simplify expressions with negative and zero exponents.
2. Factor a trinomial of the form $ax^2 + bx + c$ with a, b and c as integers.
3. Factor polynomials completely using a combination of methods.
4. Factor polynomials by grouping.

Extensions

1. Factor the sum and difference of cubes.
2. Factor polynomials by grouping.
3. Use laws of exponents to find products and quotients of numbers expressed in scientific notation.
4. Solve quadratic inequalities by factoring.

RATIONAL EXPRESSIONS – ALGEBRAIC FRACTIONS

Basic Skills

1. Determine values for which algebraic fractions are undefined.
2. Simplify algebraic fractions.
3. Compare numbers using ratio and proportion.
4. Multiply and divide algebraic fractions.
5. Add and subtract algebraic fractions with monomial denominators.
6. Solve equations in one variable involving algebraic fractions with numerical denominators.
7. Solve proportions.

Developmental Skills

1. Add and subtract algebraic fractions with polynomial denominators.
2. Solve fractional equations with variables in the denominators and state restrictions.
3. Solve verbal problems using fractional equations (eg., work, distance, investment, etc.).
4. Solve problems involving direct and inverse variation.
5. Solve ratio and proportion problems.

Extensions

1. Simplify complex fractions.
2. Solve problems involving joint and combined variation.
3. Solve fractional equations for any variable.

FUNCTIONS, RELATIONS AND GRAPHS

Basic Skills

1. Identify relations and functions from ordered pairs, graphs and equations.
2. Identify the domain and range of a linear function.
3. Graph ordered pairs.
4. Graph linear equations and functions using a table of values.
5. Find the slope of a line given two points.
6. Identify the slope and y-intercept in an equation of the form $y = mx + b$.
7. Graph a linear equation using slope and y-intercept.
8. Name the x and y-intercepts for the graph of a given equation.

Developmental Skills

1. Graph linear equations using the x and y-intercept method.
2. Find slope of a line given an equation.
3. Find slope of a line by inspection of its graph.
4. Write the equation of a line in standard form given:
   a. the slope and y-intercept
   b. two points.
   c. a point and a slope.
5. Recognize parallel and perpendicular lines from slopes.
6. Find the coordinates of the midpoint of line segment given coordinates of the endpoints.

Extensions

1. Graph inequalities in a coordinate plane.
2. Graph a quadratic function of the type $f(x) = x^2 + c$.
3. Graph a quadratic function of the type $f(x) = ax^2 + c$.
4. Write the equation of line parallel or perpendicular to a line, given a linear equation.

SYSTEMS OF EQUATIONS

Basic Skills

1. Solve a system of equations with two variables by graphing.
2. Solve a system of equations with two variables by addition (linear combination).

Developmental Skills

1. Solve a system of equations with two variables by substitution.
2. Solve word problems using systems (eg., age, perimeter, motion, digits, coin, number, value, mixture, etc.).

Extensions

1. Solve a system of inequalities.
2. Solve a system of equations having three variables.
3. Determine whether a system of equations has one solution, no solutions or infinitely many solutions.

IRRATIONAL NUMBERS AND RADICALS

Basic Skills

1. Establish order of rational numbers.
2. Find approximations for radical expressions by using the table of square roots.
3. Simplify square root radicals with numerical radicands.
4. Simplify square root radicals with variable expressions.

Developmental Skills

1. Rationalize the denominator of expressions containing radicals.
2. Simplify sums and products of radical expressions.
3. Solve simple radical equations.
4. Apply the Pythagorean Theorem and its converse.
5. Change terminating and repeating decimals to rational numbers.

Extensions

1. Simplify radicals of higher order.
2. Solve radical equations of intermediate difficulty.
3. Find the distance between two points.
4. Write a radical expression in exponential form.
5. Know that $i = -1$.

QUADRATICS

Basic Skills

1. Solve elementary quadratics of the form $x^2 = c$.

Developmental Skills

1. Solve quadratic equations with real roots using the quadratic formula.
2. Solve verbal problems using quadratic equations.

Extensions

1. Solve quadratic equations with real roots by completing the square.
2. State the sum and product of the roots of a quadratic equation.
3. Identify the discriminant and determine the nature of the roots.
4. Identify the maximum number of solutions of an equation from its degree (Fundamental Theorem of Algebra).

TRIGONOMETRY

Basic Skills

(None)

Developmental Skills

(None)

Extensions

1. Compute the value of the complement and supplement of a given angle.
2. Find missing length in similar triangles.
3. Define sine, cosine and tangent ratios.
4. Read trigonometric tables.
5. Solve a right triangle using trigonometric ratios.
6. Apply trigonometric functions to elementary verbal problems.

Geometry

FUNDAMENTAL ELEMENTS OF GEOMETRY

Basic Skills

1. Recognize point, line and plane as undefined terms.
2. Draw and name representatives of points, lines and planes.
3. Define ray, segment, collinear points, coplanar points, concurrent lines and space.
4. Write symbols for lines, rays, segments, angles and distance.
5. Define betweenness of points.
6. Define congruent segments, midpoint of a segment, bisector of a segment and opposite rays.
7. Identify and apply the information conveyed by a diagram.
8. Distinguish between congruent (meaning same shape and same size) and equal (meaning same).

Developmental Skills

1. State basic postulates about points, lines and planes.
2. Identify half-planes.

Extensions

1. Represent spatial relationships (draw) in perspective.
2. Describe convex sets and plane separation.
3. Apply the concept of sets, including subsets and the operations of union and intersection, to geometric figures.
4. Define concurrent lines.

REASONING

Basic Skills

1. Identify hypotheses and conclusions of statements.
2. Write statements in if-then form.
3. Distinguish between the meanings of "and" and "or."

Developmental Skills

1. Distinguish between intuitive, inductive and deductive reasoning.
2. State the inverse, converse and contrapositive of a statement and state which are equivalent.
3. Write if and only if statements as compound implications.

Extensions

1. Draw diagrams to represent if-then statements.
2. Construct a truth table for a given statement.
3. Distinguish between valid and invalid arguments.

OTHER GEOMETRICAL SYSTEMS

Basic Skills

(None)

Developmental Skills

1. Distinguish neutral geometry (all geometry prior to the parallel postulate) from other geometries (Euclidean, hyperbolic and spherical).

Extensions

1. Identify the components of a deductive system: undefined terms, defined terms, assumptions (axioms or postulates) and theorems.
2. Investigate and analyze other geometries such as nonEuclidean geometry (hyperbolic, spherical, and taxicab), projective geometry, finite geometry and compare them with Euclidean geometry.
3. Recognize the arbitrary nature of undefined terms, definitions and assumptions (axioms or postulates).

PARALLEL AND PERPENDICULAR LINES AND PLANES

Basic Skills

1. Define and identify lines parallel or perpendicular to other lines.
2. Define and identify planes parallel or perpendicular to other planes.
3. Define and identify lines parallel or perpendicular to planes.
4. Distinguish between parallel lines and skew lines.
5. Identify angles formed by parallel lines intersected by a transversal (corresponding, alternate-exterior, alternate-interior, same-side-interior and same-side-exterior).

Developmental Skills

1. State and apply postulates and theorems used to prove two lines parallel.
2. Define a transversal.

Extensions

1. Prove two lines parallel using an indirect proof.

PROOFS

Basic Skills

1. List the four kinds of reasons used in a proof (definition, postulates, theorems and corollaries).
2. Apply definitions, postulates, theorems and corollaries as reasons in proofs.
3. Apply properties of real numbers from algebra in problem solving and proofs.
4. Distinguish between postulates and theorems.
5. List the parts of a proof (diagram, given, prove, statement and reason).

Developmental Skills

1. Write indirect proofs.
2. Write an original two-column proof of a theorem.

Extensions

1. Write an original flow proof of a theorem.
2. Write an original paragraph proof of a theorem.
3. Prove a theorem by exhaustion (eg., finite geometry).
4. Prove some theorems using more than one approach (synthetic, coordinate, transformational and/or vector).

ANGLES

Basic Skills

1. Define an angle.
2. Name angles in a plane.
3. Identify points in the exterior, the interior and on the angle.
4. Recognize and illustrate complementary, supplementary, adjacent, right, obtuse, acute, vertical angles, congruent angles and angle bisector.
5. Classify angles (acute, right, obtuse).
6. Measure angles in various positions using a protractor.

Developmental Skills

1. Identify and recognize dihedral angles.

Extensions

1. Name and recognize polyhedral angles.

TRIANGLES

Basic Skills

1. Define a triangle.
2. Classify triangles according to sides and angles.
3. State and apply the theorem about the sum of the angles of a triangle.
4. Define and identify medians and altitudes of a triangle.
5. State properties of isosceles and equilateral triangles.

Developmental Skills

1. Apply theorems and corollaries relating to isosceles and equilateral triangles.
2. State and apply the theorem about the segment that joins the midpoints of two sides of a triangle.
3. State and apply inequality relations for one and two triangles.
4. Apply theorem relating to the measure of an exterior angle of a triangle.

Extensions

(None)

RIGHT TRIANGLES AND TRIGONOMETRY

Basic Skills

1. Define right triangle, leg and hypotenuse.
2. Simplify radicals and rationalize denominators.
3. Solve problems using irrational numbers.
4. State the Pythagorean theorem and its converse.
5. Apply the Pythagorean theorem in proofs and practical problems.
6. Determine the lengths of all sides of a 45-45-90 triangle and a 30-60-90 triangle when given the length of one side.
7. Apply distance formula and midpoint formula.

Developmental Skills

1. State and apply the relationships that exist when the altitude is drawn to the hypotenuse of a right triangle.
2. Determine the length of the diagonals of rectangles.

Extensions

1. Determine the geometric mean between two numbers.
2. State definitions of sine, cosine and tangent ratios for an acute angle in a right triangle.
3. Apply right triangles theorems to solve problems involving pyramids and cones.
4. Solve application problems by using trigonometric ratios or special triangles (30-60-90; 45-45-90).
5. Determine the length of the diagonal of a rectangular solid.

QUADRILATERALS AND POLYGONS

Basic Skills

1. Define polygon and regular polygon.
2. Distinguish between convex and concave polygons.
3. Recognize and name convex polygons with 3, 4, 5, 6, 8 and 10 sides.
4. Define parallelogram, rectangle, square, rhombus, kite and trapezoid.
5. Identify the special properties of parallelograms, rectangles, rhombuses and squares.
6. Define the median of a trapezoid.
7. Identify opposite and consecutive angles and opposite and consecutive sides of a polygon.

Developmental Skills

1. State and apply the formula for finding the sum of interior angles of any regular polygon.
2. Apply the fact that the sum of the exterior angles of any convex polygon is 360.
3. Define an n-gon.
4. State and apply theorems about properties of parallelograms.
5. State and apply conditions sufficient to show that a quadrilateral is a parallelogram.
6. Recognize the subset relationships between quadrilaterals, trapezoids, parallelograms, squares, rectangles and rhombuses.
7. State and apply the theorems about the median of a trapezoid.
8. Identify and find the measure of the apothem, central angle and radius of a regular polygon.

Extensions

(None)

CONGRUENT TRIANGLES AND POLYGONS

Basic Skills

1. Identify the corresponding parts of congruent figures.
2. State sufficient conditions to show two triangles congruent (SSS, SAS, ASA, AAS, HA, HL, LA, LL).

Developmental Skills

1. Prove two triangles congruent (including over-lapping triangles) by using SSS, ASA, SAS and AAS.
2. Apply the statement that corresponding parts of congruent polygons are congruent in proofs and problem-solving.
3. Prove two segments or angles congruent by first proving two polygons are congruent.
4. Prove two right triangles congruent by using the specific theorems HA, LL, LA and HL.

Extensions

(None)

SIMILARITY

Basic Skills

1. Define similar figures.
2. Express a ratio in simplest form.
3. Solve for the value of an unknown term in a given proportion.
4. State and apply properties of similar polygons.

Developmental Skills

1. Interpret maps and scale drawings.
2. Solve application problems related to similar polygons using ratios, proportions and the geometric mean.
3. Prove triangles similar by using AA or sides in proportions.
4. Conceptualize similarity as same shape but not necessarily same size.
5. Distinguish between similar figures and congruent figures.

Extensions

1. State and apply the bisector of an angle of a triangle theorem.
2. Write a proportion in several forms.

CIRCLES

Basic Skills

1. Define and identify circle, radius, chord, diameter, tangent, secant, concentric circles, central angle, minor arc, major arc, inscribed angle, segment and sector.
2. State properties involving arcs and central angles.
3. Solve problems involving inscribed angles and angles formed by secants and tangents.
4. Solve problems involving the lengths of chords, secant segments and tangent segments.

Developmental Skills

1. State and apply theorems that relate tangents and radii.
2. State and apply theorems about the chords of a circle.

Extensions

1. Prove theorems involving inscribed angles and angles formed by secants and tangents.

SOLIDS

Basic Skills

1. Identify cubes, rectangular solids, cones, prisms, cylinders, pyramids and spheres.
2. Identify parts (eg., faces, bases, vertices, edges, slant, height, altitude) of prisms, pyramids, right circular cylinders and right circular cones.
3. Identify a diagonal of a rectangular solid.

Developmental Skills

1. Define a sphere, cube, rectangular solid, prism, cone, cylinder and pyramid.
2. Distinguish between right and oblique solids.
3. Define polyhedron and regular polyhedron.

Extensions

1. Name the five regular polyhedrons (cube, tetrahedron, octahedron, dodecahedron and icosahedron).
2. Discover Euler's formula ($F + V = E + 2$) relating faces, vertices and edges of polyhedra.

PERIMETER, AREA AND VOLUME

Basic Skills

1. Define perimeter, area and volume.
2. State the formulas for the areas of rectangles, parallelograms, triangles and trapezoid.
3. Apply the formulas for the areas of rectangles, parallelograms, triangles and trapezoid.
4. State the formulas for the circumference and area of a circle.
5. Compute the circumference and area of a circle.
6. Calculate the perimeter of a polygon.

Developmental Skills

1. Apply the area formula for a regular polygon.

2. Find the lateral area, total area and volume of right prisms, regular pyramids, right circular cylinders and right circular cones, given the formulas.
3. Compute the surface area and volume of a sphere, given the formulas.

Extensions

1. Demonstrate that noncongruent polygons may have the same size (piecewise congruence).
2. Compute the arc length and areas of sectors and segments of a circle, given the formulas.
3. Calculate the areas of a triangle using Hero's formula $A = S(S-A)(S-B)(S-C)$ where $S = {}^{m}P$.
4. Conceptualize the similarities between the formulas for cones and pyramids ($V = 1/3\ Bh$) and for prisms and cylinders ($V = Bh$).

CONSTRUCTION AND LOCI

Basic Skills

1. Recognize that constructions use only compass and straightedge.
2. Copy a segment.
3. Copy an angle.
4. Bisect a line segment.
5. Bisect an angle.
6. Construct a line perpendicular to a given line at a given point on the line.
7. Construct a line perpendicular to a given line from a point not on the line.

Developmental Skills

1. Construct the perpendicular bisector of a line segment.
2. Construct a parallel line through a point not on a given line.
3. Construct a parallel line at a given distance from a given line.
4. Construct the midpoint of an arc of a circle.
5. Construct the center of a circle given an arc.
6. Construct a tangent to a circle from a point on the circle.
7. Construct a tangent to a circle from a point outside the circle.
8. Circumscribe a circle about a triangle.
9. Inscribe a circle in a triangle.
10. Divide a line segment into n congruent segment.
11. Constuct a circle through three given non-collinear points.
12. Construct the altitudes (orthocenter), medians (centroid), angle bisectors (incenter) and perpendicular bisectors (circumcenter) of a triangle.
13. Define locus as the set of points that satisfies one or more conditions.

Extensions

1. Realize that basic constructions can be accomplished by constructing a rhombus.
2. Given three segments construct a fourth segment so that the lengths of the segments are in proportion.
3. Given two segments, construct a segment whose length is the geometric mean between the lengths of the given segments.
4. Construct a nine-point circle.
5. Describe, using locus concepts, how a constructed figure relates to a given figure.

6. Describe the locus of points in a plane and in space that are:
   a. a given distance from a given point
   b. a given distance from a given line
   c. equidistant from parallel lines
   d. equidistant from two given points
7. Describe the locus of points in a plane that are equidistant from the sides of an angle.
8. Discuss impossible constructions such as trisecting an angle and duplicating a cube.

COORDINATE GEOMETRY

Basic Skills

1. Locate the x-axis, y-axis, origin and the quadrants on a rectangular coordinate system.
2. Specify points by coordinates in the coordinate plane.
3. Find the slope of a line.
4. Determine whether two lines are parallel, perpendicular or neither.
5. Graph a line when given either the slope and one point on the line or two points on the line.

Developmental Skills

1. State and apply distance and midpoint formulas for a line segment.
2. Specify points by coordinates in three-dimensional space.
3. Write the equation of a circle in general form.
4. Write the equation of a line when given either the slope and one point on the line or two points on the line.
5. Find the coordinates of the intersection of two lines.
6. Graph a line when given an equation in point-slope form, standard form or slope-intercept form.

Extensions

1. Determine convenient placement of a given polygon on the coordinate axes and assign coordinates to vertices.
2. Determine the coordinate of the fourth vertex of a parallelogram given the coordinates of the other three.
3. Prove theorems by using coordinate geometry methods.
4. Find the distance between two parallel lines.
5. Find the distance from a point to a line.

TRANSFORMATIONS

Basic Skills

(None)

Developmental Skills

1. Given a figure, determine the number of lines of symmetry and the number of points of symmetry.
2. Define and identify transformations, line reflections, rotations, half-turns and translations.
3. Draw the images of figures under reflections, half-turns, rotations and translations.

Extensions

1. Given the coordinates of the image of a figure following a transformation.
2. Define and identify dilations and glide reflections.
3. Draw the image of a figure under a dilation or a glide reflection.

TOPOLOGY

Basic Skills

(None)

Developmental Skills

(None)

Extensions

1. Identify figures that are topological equivalent.
2. Make a moebius strip and determine if other strips with more twists have the same properties.
3. Describe a klein bottle.
4. Apply the properties and formulas used in networking problems.
5. Demonstrate certain topological properties via "magic tricks."

Algebra II

REAL NUMBERS

Basic Skills

1. Recognize and use set notation and symbols.
2. Simplify numerical expressions using the order of operations and or symbols of inclusion.
3. Identify natural, whole, intergral, rational, irrational and real numbers.
4. Interpret and draw number line graphs.
5. Evaluate algebraic expressions.
6. Recognize and use the addition and multiplication properties (e.g., property of zero, property of negative one, etc.).
7. Recognize and use the properties of equality.
8. Define subtraction and division in terms of addition and multiplication.
9. Identify the properties of real numbers (i.e., commutative, associative, closure, etc.).
10. Add, subtract, multiply and divide directed numbers.

Developmental Skills

(None)

Extensions

1. Prove theorems of real numbers using the axioms of real numbers.
2. Construct truth tables involving inference, conjunction and disjunction.
3. Prove algebraic statements using indirect proof.

FIRST DEGREE EQUATIONS AND INEQUALITIES

Basic Skills

1. Add and subtract polynomials.
2. Solve equations and inequalities in one variable and graph the results on a number line.
3. Solve and graph equations that involve absolute value.
4. Recognize properties of order including addition and multiplication and the transitive law.

Developmental Skills

1. Solve and graph inequalities that involve absolute value.
2. Translate a verbal statement of a problem to a symbolic statement in one variable, solve the resulting statement and apply the solution set to the verbal problem.

LINEAR FUNCTIONS AND RELATIONS

Basic Skills

1. Compute the slope of a line when given:
   a. the graph of a line
   b. the coordinates of 2 points
   c. the equation of a line in any form; e.g., ($ax + by = c$ or $y = mx + b$).
2. Write the equation of a line when given:
   a. a slope and y-intercept
   b. a slope and a point on the line
   c. two points on the line
3. Graph a linear equation by:
   a. plotting ordered pairs
   b. plotting x and y intercepts
   c. plotting the y-intercept and using the slope
   d. plotting a point and using the slope
4. Define relation and function and demonstrate with mapping diagrams and/or graphs (include finding a specific function value).
5. Categorize sets of ordered pairs, graphs and equations as functions or relations.
6. Define and identify the domain and range of a function.
7. Solve problems involving direct variation using ratio and proportion.
8. Graph linear inequalities.

LINEAR SYSTEMS

Basic Skills

1. Find the solution set of a pair of linear equation by graphing, substitution and linear combination.
2. Graph the solution sets of linear inequalities or a system of such inequalities.

Developmental Skills

1. Use pairs of linear equations in two variables to solve word problems.
2. Solve systems of more than two linear equations.
3. Solve word problems using linear programming.
4. Find the solution set of a system of three equations in three variables, i.e., using substitution, linear combination or Cramer's Rule.

Extensions

1. Graph points, lines and planes in three-space.
2. Explore properties of determinants.

MULTIPLICATION AND FACTORIZATION OF POLYNOMIALS

Basic Skills

1. Perform the basic simplifications using the laws of exponents.
2. Multiply polynomials by a monomial, binomial, trinomial, etc.
3. Factor polynomials involving:
   a. greatest common factor
   b. difference of squares
   c. perfect square trinomial
   d. quadratic trinomials (trial and error)
   e. sum and difference of cubes
   f. more than three terms
4. Solve quadratic equations using factoring (problems and word problems).

Developmental Skills

1. Solve quadratic inequalities and record the results on a number line graph.

Extensions

1. Solve cubic and/or quartic inequalities and record the results on a number line graph.
2. Explore writing any term of a binomial using the binomial theorem.

RATIONAL EXPRESSIONS

Basic Skills

1. Define a^n and a^{-n}, $n \in$ integers, and simplify algebraic expressions containing these.
2. Simplify an algebraic rational expression.
3. Divide algebraic expressions by long division.
4. Add, subtract, multiply and divide rational algebraic expressions.
5. Solve equations containing fractions and solve fractional equations.

Developmental Skills

1. Solve word problems containing rational expressions.

IRRATIONAL EXPRESSIONS

Basic Skills

1. Evaluate radicals to determine the number of roots and whether or not the roots are rational, irrational or neither.
2. Simplify radicals.

3. Add, subtract, multiply and divide radical expressions.
4. Solve equations, involving radicals, over their real numbers or recognize that no real number solution exists.
5. Use the rational root theorem (p/g) to determine the possible rational roots of a polynomial equation.
6. Change any fraction to a decimal (including repeating decimals).
7. Change a finite or repeating decimal to a fraction.
8. Identify a rational or an irrational number between two given numbers.

Developmental Skills

(None)

Extensions

1. Use the rational root theorem and indirect proof to prove a number is irrational.

COMPLEX NUMBERS

Basic Skills

1. Define i and evaluate i^n where $n \in N$.
2. Simplify radicals with negative radicands.
3. Express a complex number in the form $a + bi$.
4. Add, subtract, multiply and divide complex numbers and express answers in simplest form.

Developmental Skills

1. Write complex number conjugates.

Extensions

1. Prove theorems involving complex conjugates and absolute value of complex numbers.
2. Sketch the graph of a complex number.

QUADRATIC EQUATIONS, FUNCTIONS AND INEQUALITIES

Basic Skills

1. Solve equations by completing the square and using the quadratic formula over the real numbers.
2. Solve quadratic equations over the complex numbers.
3. Determine the nature of the roots of a quadratic equation by using its discriminant.
4. Use the relationship of roots and coefficients to write quadratic equations.

Developmental Skills

1. Use the method of completing the square to change $y = ax^2 + bx + c$ into $y = a(x - h)^2 + k$, identify the vertex and axis of symmetry and determine whether the vertex is a maximum or minimum and graph the result.
2. Solve and graph quadratic inequalities.

Extensions

1. Derive the quadratic formula from $ax^2 + bx + c = 0$.
2. Solve maximum/minimum word problems.

POLYNOMIAL FUNCTIONS

Basic Skills

1. Use synthetic division for:
   a. substitution
   b. long division
   c. determining roots and factors

Developmental Skills

1. Use the fundamental theorem of algebra and synthetic substitution to find the roots of polynomial equations.

Extensions

1. Sketch the graph of polynomial equations (Descartes rule of signs may be applied).

ANALYTIC GEOMETRY

Basic Skills

1. Find the distance between any two points and determine the coordinates of the midpoint of the line segment joining them.
2. Determine the slope of a line perpendicular to a given line.
3. Determine the slope of a line parallel to a given line.
4. Write the equation of a line perpendicular or parallel to a given line through a given point.

CONIC SECTIONS

Basic Skills

1. Define the parabola, recognize its equation, identify the vertex and axis of symmetry and sketch its graph.
2. Define the circle, recognize its equation, identify the radius and center and sketch its graph.
3. Define the ellipse, recognize its equation and sketch its graph.
4. Define the hyperbola, recognize its equations and sketch its graph.

Developmental Skills

1. Write the equation of a parabola given the vertex.
2. Write the equation of a circle given enough information to know the center and radius.
3. Know the relationship of an ellipse to its foci, focal radii, intercepts, major and minor axes and write an equation of an ellipse using such information.
4. Know the relationship of a hyberbola to its foci, intercepts, asumptotes, transverse and conjugate axes and write an equation using such information.
5. Define inverse variation, and use inverse, direct and joint variations to solve problems.
6. Use graphs to determine the number of real solutions of a quadratic system and to estimate the solutions.
7. Use substitution or linear combination to find exact solutions to quadratic systems (problems and word problems).

EXPONENTIAL AND LOGARITHMIC FUNCTIONS

Basic Skills

1. Extend the laws of exponents to include rational and irrational numbers.
2. Write radical expressions in exponential form and simplify.
3. Define and recognize exponential functions.
4. Find the inverse of a function.
5. Define logarithms and relate the logarithmic form to exponential form to solve equations.

Developmental Skills

1. Sketch the graph of a function and its inverse. Indicate whether or not the inverse is a function.
2. Perform composition of functions.
3. Use logarithmic tables and interpolation to find the common logarithm or antilogarithm of a number.
4. Use the laws of exponents to perform computations and solve equations.

Extensions

1. Graph an exponential function.
2. Define "e" and the natural logarithm.
3. Use exponential and logarithmic functions to study topics such as compound interest, growth and decay.

SEQUENCES AND SERIES

Basic Skills

(None)

Developmental Skills

1. Identify arithmetic and geometric sequences.
2. Use the formulas for arithmetic and geometric sequences to find:
   a. specific terms
   b. arithmetic and geometric means between two terms
   c. the number of a specific term
   d. the common difference or common ratio

Extensions

1. Find the sums of arithmetic series or finite geometric series and be able to write the series in summation notation.
2. Solve word problems involving arithmetic and geometric sequences and series.
3. Find the sum of an infinite geometric series having $|r| < 1$. (Introduce the concept of limit and change repeating decimals to fractions using geometric series).
4. Expand powers of binomials using Pascal's Triangle and the binomial theorem.
5. Find the kth term in a binomial expansion.

MATRICES AND DETERMINANTS

Basic Skills

(None)

Developmental Skills

(None)

Extensions

1. Give the dimensions of any given matrix.
2. Add and subtract matrices.
3. Multiply a matrix by a scalar.
4. Find the product of two matrices.
5. Find the determinant of any square matrix by expansion by minors.
6. Find the inverse of 2 x 2 matrix.
7. Solve a system of equations using Cramer's Rule or matrix equations.

PROBABILITY

Basic Skills

(None)

Developmental Skills

(None)

Extensions

1. Use the fundamental counting principle to solve problems.
2. Use the definition of permutation to give the number of arrangements in linear and circular permutations.
3. Find the number of distinguishable permutations in a given set.
4. Use the combination formula to count subsets.
5. Find combinations formed from several sets.
6. Expand binomial expressions using the binomial theorem and find the coefficients of the terms in the binomial expansion.
7. Generate the numbers in Pascal's Triangle and relate the numbers to the coefficients of the terms in the binomial expansion.
8. Write a sample space for a given event.
9. Find the probability, complement and odds of an event.
10. Find the probability of mutually exclusive, mutually inclusive, independent and dependent events.

TRIGONOMETRY

Basic Skills

(None)

Developmental Skills

(None)

Extensions

1. Express angle measure in degrees and radians.
2. Solve some simple circular motion problems, relating the radian measure of the central angle to the length of the intercepting arc.
3. Define the cosine and sine in terms of coordinates of a point on a circle. Indicate the fact that, on the unit circle, the abscissa and ordinate are the cosine and sine.
4. Use the 30-60-90 triangle and the 45-45-90 triangle to show values for the sine and cosine of special arc lengths.
5. Define the periodic function and find reference angles for obtuse angles and negative angles.

6. Define the tangent, cosecant, secant and cotangent.
7. Use tables of trigonometric functions and interpolation to find the value of any trigonometric function of any angle.
8. Use trigonometric functions to solve right triangles (include reading problems).
9. Sketch the graphs of the trigonometric functions using amplitude, period, phase, shift, vertical shift and points as needed.
10. Verify identities.
11. Find the area of a triangle given two sides and the included angle.
12. Use the law of sines and law of cosines to solve oblique triangles (include reading problems).
13. Use the identities for the sine and cosine of the sum or difference to derive and verify more identities such as the double angle and half-angle identities.
14. Define inverse functions, principal inverse functions and evaluate expressions containing these.
15. Solve trigonometric equations.

Advanced Mathematics

ANALYTIC GEOMETRY

Basic Skills

1. Write a linear equation in standard form, slope-intercept form and intercept form.
2. Write the rectangular equation of a line given:
   a. a point and the slope
   b. the intercepts
   c. the slope and y-intercept
   d. two points
3. Sketch the graph of a linear equation.
4. Determine whether two lines are parallel, perpendicular or neither by comparing slopes.
5. Find the distance from a point to a line.
6. Solve systems of linear equations.
7. Sketch the graph of a linear inequality and systems of linear inequalities.

Developmental Skills

1. State the definition of each conic.
2. Identify conics or the degenerate cases from given equations.
3. Write the equation of a conic in appropriate form to determine the information needed to graph the conic.
4. Write the equation of a circle, parabola, ellipse or hyperbola given sufficient information.
5. Solve linear – quadratic systems and quadratic – quadratic systems and relate the solutions to the graph of the systems.
6. Graph linear – quadratic systems and quadratic – quadratic systems of inequalities.
7. Transform the equation of a conic by translating the origin to (h,k) and sketch the graph.
8. Rotate the axes to remove the xy term from the equation of a conic and sketch the graph.

LOGARITHMIC AND EXPONENTIAL FUNCTIONS

Basic Skills

1. Define logarithms.
2. Identify logarithms and exponential functions.
3. Sketch the graph of logarithmic and exponential functions including $y = \ln x$ and $y = c^x$.
4. State the laws of exponents. Use these laws to prove the laws of logarithms.
5. Simplify long expressions and solve log equations.
6. Verify that the logarithmic functions and exponential function are inverses.
7. Solve equations of the form $a^x = b$ by using logarithms.
8. Determine the value of $\log b^a$.

SEQUENCES AND SERIES

Basic Skills

1. Distinguish between arithmetic and geometric progressions.
2. Distinguish between arithmetic and geometric series.
3. Find the n^{th} term of an arithmetic progression or geometric progression.
4. Find the sum of n terms of arithmetic series or geometric series.
5. Find the sum of an infinite geometric series.
6. Determine if a series is convergent or divergent.

PERMUTATIONS AND COMBINATIONS

Basic Skills

1. Mathematical induction:
   a. State the induction principle
   b. Write proofs using the induction principle.
2. Simplify expressions using factorial principle.
3. State the fundamental counting principle and determine the number of arrangements using that principle.
4. State the definition of a permutation and work problems by using permutation formulas.
5. State the definition of a combination and work problems by using combination formulas.
6. Solve problems by using the formula for circular permutations.
7. Write $(a + x)^n$ in expanded form using the binomial theorem.
8. Determine the nth term of $(a + x)^n$ using the binomial theorem.
9. Determine the coefficients of an expanded binomial using Pascal's triangle.

PROBABILITY

Basic Skills

1. Determine the probability of the success or failure of some event.
2. Find the odds of a particular event being successful.
3. Given two or more independent events, find the probability of both occurring.
4. Given two or more dependent events, find the probability of both events occurring.
5. Define mutually exclusive events.
6. Determine the probability of either a or b occurring if a and b are mutually exclusive.
7. Define inclusive events.
8. Find the probability of a or b occurring if a and b are inclusive.
9. Define conditional probability of two events.
10. Determine the conditional probability of event a given event b.

MATRICES AND DETERMINANTS

Basic Skills

1. Perform the following operations with matrices:
   a. addition
   b. subtraction
   c. scalar multiplication
   d. multiplication
2. Define a determinant.
3. Find the minor and cofactors of an element of a determinant.
4. Rewrite a determinant using elementary row (column) operations.
5. Evaluate determinants of order greater than three.
6. Write an identify matrix for addition and multiplication.
7. Write the transpose and inverse of a matrix.
8. Show by example which field properties are satisfied by matrix multiplication and addition.
9. Solve a matrix equation.
10. Solve a system of equations by Cramer's Rule.
11. Solve a system of equations by using a matrix equation.

POLAR FORMS

Basic Skills

1. Convert polar coordinates to Cartesian coordinates.
2. Convert Cartesian coordinates to polar coordinates.
3. Plot points in polar form.
4. Sketch the graph of a polar equation.
5. Change polar equations to Cartesian equations.
6. Change Cartesian equations to polar equations.
7. Identify the graph of a polar equation.
8. Solve a system of polar equations.

COMPLEX NUMBERS

Basic Skills

1. Express complex numbers in the form a + bi and perform the four mathematical operations.
2. Express a complex number in polar form.
3. Rewrite complex numbers of the form $z = (r \cos \emptyset)^n$ or $(r \cos 0)^{1/n}$ using DeMoivre's Theorem.
4. Multiply and divide complex numbers written in the form $z = r \cos \emptyset$.
5. Find all zeros of a function of the form $x^n = b$ when not all zeros are complex.

LOGIC

Basic Skills

1. State the definition of a proposition.
2. Symbolize statements with propositional variables.
3. Write symbols for the universal and existential quantifiers.
4. Write truth tables for:
   a. negation of variables
   b. conjunction and disjunction
   c. implication and equivalence
5. Construct truth tables to determine validity of statements.
6. Verify tautalogies such as:
   a. detachment
   b. contrapositive
   c. modus tollens
   d. commutativity
   e. DeMorgan's Law
   f. negation for implication
7. Show that indirect proof is a tautology.

Analysis of Algebraic Functions

REAL NUMBER PROPERTIES

Basic Skills

1. Identify members of a set written in roster, incomplete roster and set-builder notation.
2. Designate a set using roster notation, incomplete roster notation and/or set builder notation.
3. Determine the intersection, union and complement of a given set.
4. List the field axioms and illustrate each axiom with an example.
5. List the order axioms and illustrate each axiom with an example.
6. State the completeness axiom and use it to find the least upper bound and/or the greatest lower bound of a set.
7. Sketch the graphs of linear, quadratic and fractional inequalities on a real number line and write the solution using interval notation.
8. Use the definition of absolute value to sketch graphs of absolute value on a real number line. Depict the solution using inverval notation.

FUNCTIONS AND RELATIONS

Basic Skills

1. State a definition of a relation and a function. Give example.
2. State a definition for domain and range.
3. Relate abscissa and ordinate of a point in the Cartesian Coordinate system to the domain and range of a function.
4. Illustrate functions by using the rule method, set notation and mapping.
5. Identify range and/or domain of functions that have restricted values $f(x) = |x| + 4$, $f(x) = 3/x-1$,

6. Use function notation with the operations of addition, subtraction, multiplication and division.
7. Find the composition of functions.
8. Use the domains of two or more functions to determine the domain of a function resulting from arithmetic operations on or composition of the original functions.
9. Sketch the graphs of functions resulting from addition, subtraction, multiplication, division or composition of two or more functions.
10. Determine the sum, difference, product or quotient of two polynomial functions.
11. Define onto functions and give an example.
12. Define 1-1 function and give an example.
13. Define the inverse of a function and give an example.
14. Use a linear equation to illustrate the relationship between a function and its inverse.
15. Sketch the graphs of a linear equation and its inverse and show their relationship to $y = x$.

THEORY OF EQUATIONS

Basic Skills

1. Use synthetic division to divide any polynomial by x-c.
2. Use synthetic division to find a specific value of a polynomial function.
3. Find upper and lower bounds of the zero of a polynomial function.
4. Use Descartes Rule of Signs to determine the possible number of positive and negative real zeros.
5. Use the Factor Theorem, the Rational Root Theorem, the Remainder Theorem, the Fundamental Theorem of Algebra, and Descartes Rule of Sings to find real zeros of a polynomial function. When the equation is quadratic, find all zeros.
6. Explain the relationship between factors, remainders, zeros and x-intercepts.

GRAPHS OF ALGEBRAIC FUNCTIONS

Basic Skills

1. Distinguish between an algebraic function and a rational function.
2. Determine the following for different types of algebraic functions:
   a. domain and range
   b. symmetry with respect to the x-axis, y-axis and the origin
   c. x- and y- intercepts
   d. vertical and/or horizontal asymptotes
3. Sketch graphs of different kinds of algebraic functions.

GRAPHS OF ALGEBRAIC RELATIONS

Basic Skills

1. Determine the following for algebraic relations:
   a. domain and range
   b. symmetry with respect to x - axis, y - axis and the origin
   c. x - and y - intercepts
   d. vertical and/or horizontal asymptotes
2. Sketch graphs of algebraic relations that are not functions.

GRAPHS OF SPECIAL FUNCTIONS

Basic Skills

1. Write in functional notation an example of each of the following functions: absolute value function, step function, signum function, step function, greatest integer function and other split-domain functions.
2. Determine domain and range for each of the above examples.
3. Sketch the graphs of each of the above functions.

Trigonometry

This guide is designed as a one-semester course in trigonometry. It is intended to provide a thorough treatment of trigonometry with a judicious study of basic formulas. Students enrolled in trigonometry are assumed to have mastered those topics considered basic to Algebra II.

After the use of tables has been mastered, the student should be encouraged to use calculators to emphasize the principles of trigonometry instead of computation. Microcomputers will enhance demonstrations of graphs of the functions and ideas such as amplitude, period and phase shift.

The right triangle approach has been taken to introduce trigometric functions. Another approach would be to begin with circular functions. Either approach is mathematically sound but both approaches must be covered in the course of study. No matter which approach is taken, students upon the completion of the trigonometry course, should have mastered the basic skills. Students should be able to demonstrate a degree of proficiency in the developmental skills.

Trigonometric ratios in the right triangle.

Basic Skills

1. Define six trigonometric ratios for either acute angle in a right triangle.
2. Compute and recognize the six trigonometric ratios for a 30°, 45° and 60° right triangle.
3. Find the values of the six trigonometric ratios using tables and using calculators.
4. Find lengths of the sides of a right triangle using tables.
5. Solve application problems involving right triangles.
6. Solve application problems using vectors.

Angular Measure. (Work effectively in both circular (radians) and sexagesimal (degree) measure).

Basic Skills

1. Interpret positive and negative angles in degrees.
2. Convert from degrees to radians.
3. Convert from radians to degrees.

Developmental Skills

1. Solve application problems involving angular velocity.
2. Solve application problems involving arc length.

Circular Function

Basic Skills

1. Define the six trigonometric functions. (Review of functions may be necessary).
2. Find the value of the six trigonometric functions of any angle using tables and interpolation.

Developmental Skills

1. Solve application problems that stress the use of tables.
2. Solve application problems using the handheld calculator.

Extensions

1. Use line segments in a unit circle to represent the trigonometric functions.

Graphs of the trigonometric functions

Basic Skills

1. Graph sine, cosine and tangent functions.
2. State the amplitude, period and phase/shift for sine and cosine functions.
3. Graph tangent function emphasizing period, asymptotes, continuity, domain and range.

Developmental Skills

1. Sketch graphs of cotangent, secant and cosecant functions.

Extensions

1. Graph trigonometric functions by addition of ordinates.
2. Solve systems of trigonometric functions graphically. (Microcomputers could be useful in showing graphs of trigonometric functions.)

Trigonometric Identities

Basic Skills

1. Verify the Pythagorean, reciprocal and quotient identities.
2. Memorize and use the sum and difference identities.

Developmental Skills

1. Memorize and use the double-angle and half-angle identities to evaluate the sine, cosine and tangent of an angle.
2. Solve trigonometric conditional equations.

Extensions

1. Memorize and use the product and factor identities.
2. Solve equations in the form a sin $\emptyset$ + b cos $\emptyset$ = c.

Oblique triangles

Basic Skills

1. Memorize and use the law of sines and law of cosines.
2. Find the area of a triangle given:
   a. two angles and a side
   b. two sides and the angle opposite one of them
   c. two sides and the included angle
   d. three sides
3. Solve application problems involving the law of sines or the cosines.
4. Solve application problem involving the area of a triangle.

Developmental Skills

1. Identify the ambiguous case and solve triangles.
2. Solve vector problems.

Extensions

1. Memorize and use the law of tangents.
2. Find the angles of a triangle using tangent of half angle formulas.
3. Solve application problems involving the ambiguous case, law of tangents and the tangent of half-angles.

Inverse Functions

Basic Skills

1. Define the principal inverse trigonometric functions.
2. Evaluate trigonometric expressions involving the inverse trigonometric functions.

Developmental Skills

1. Solve equations involving inverse trigonometric functions.

Extensions

1. Recognize the graphs of the inverse trigonometric functions.
2. Memorize and use inverse trigonometric function identities.

Polar Coordinates

Basic Skills

1. Plot points in the polar coordinate system.

Developmental Skills

1. Convert from rectangular to polar coordinates.
2. Convert from polar to rectangular coordinates.

Extensions

1. Graph polar equations emphasizing symmetry.

Complex Numbers

Basic Skills

1. Perform the four basic operations with complex numbers.
2. Express rectangular complex numbers in polar form.
3. Express polar complex numbers in rectangular forml

Developmental Skills

1. Multiply and divide complex numbers expressed in polar form.

Extensions

1 Use DeMoivre's Theorem to evaluate powers of complex numbers.
**6 Use DeMoivre's Theorem to find roots of complex numbers.